

Specification Amendment

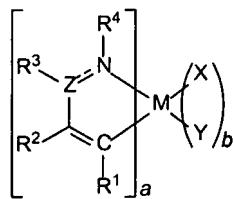
Please insert the following paragraph before paragraph [0001] immediately below the title.

Research Agreements

[0001'] The claimed invention was made by, on behalf of, and/or in connection with one or more of the following parties to a joint university-corporation research agreement: Princeton University, The University of Southern California and the Universal Display Corporation, which agreement was in effect on and before the date the claimed invention was made, and the claimed invention was made as a result of activities undertaken within the scope of the agreement. The claimed invention was also made by, on behalf of, and/or in connection with one or more of the following parties to a joint university-corporation research agreement: Princeton University, The University of Southern California and Global Photonic Energy Corp, which agreement was in effect on and before the date the claimed invention was made, and the claimed invention was made as a result of activities undertaken within the scope of the agreement.

Please amend paragraphs [0019] and [0020] as shown below.

[0019] In a preferred embodiment, the present invention provides an organic photosensitive optoelectronic device having a photoactive region comprising a cyclometallated organometallic material having the formula I



(I)

wherein

M is a transition metal having a ~~molecular~~ atomic weight greater than 40;

Z is N or C,

the dotted line represents an optional double bond,

R¹, R², R³ and R⁴ are independently selected from H, alkyl, or aryl, and additionally or alternatively, one or more of R¹ and R², R² and R³, and R³ and R⁴ together form independently a 5 or 6-member cyclic group, wherein said cyclic group is cycloalkyl,

cycloheteroalkyl, aryl or heteroaryl; and wherein said cyclic group is optionally substituted by one or more substituents Q;

each substituent Q is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two Q groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;

each R is independently selected from H, alkyl, aralkyl, aryl and heteroaryl;

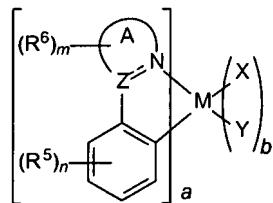
(X and Y), separately or in combination, are an ancillary ligand;

a is 1 to 3; and

b is 0 to 2;

with the proviso that the sum of a and b is 2 or 3.

[0020] In a further embodiment, the present invention provides an organic photosensitive optoelectronic device having a photoactive region comprising a cyclometallated organometallic material having the formula II



(II)

wherein

M is a transition metal having ~~a molecular~~ an atomic weight greater than 40;

ring A is an aromatic heterocyclic ring or a fused aromatic heterocyclic ring with at least one nitrogen atom that coordinates to the metal M;

Z is selected from carbon or nitrogen;

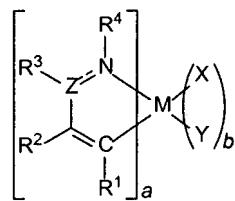
each R⁵ is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two R⁵ groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;

each R⁶ is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two R⁶ groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;

each R is independently selected from H, alkyl, aralkyl, aryl and heteroaryl;
(X and Y), separately or in combination, are an ancillary ligand;
n is 0 to 4;
m is 0 to 4;
a is 1 to 3; and
b is 0 to 2;
with the proviso that the sum of a and b is 2 or 3.

Please amend paragraph [0073] as shown below.

[0073] In a preferred embodiment, the present invention provides an organic photosensitive optoelectronic device having a photoactive region comprising a cyclometallated organometallic compound having the formula I



(I)

wherein

M is a transition metal having a molecular an atomic weight greater than 40;

Z is N or C,

the dotted line represents an optional double bond,

R¹, R², R³ and R⁴ are independently selected from H, alkyl, or aryl, and additionally or alternatively, one or more of R¹ and R², R² and R³, and R³ and R⁴ together form independently a 5 or 6-member cyclic group, wherein said cyclic group is cycloalkyl, cycloheteroalkyl, aryl or heteroaryl; and wherein said cyclic group is optionally substituted by one or more substituents Q;

each substituent Q is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two Q groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;

each R is independently selected from H, alkyl, aralkyl, aryl and heteroaryl;

(X and Y), separately or in combination, are an ancillary ligand;

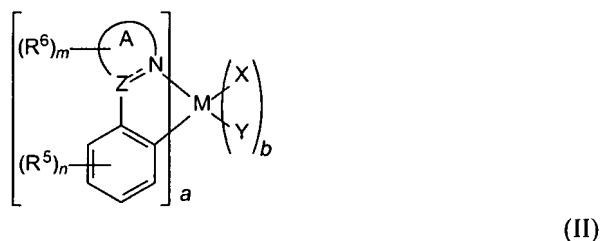
a is 1 to 3; and

b is 0 to 2;

with the proviso that the sum of *a* and *b* is 2 or 3.

Please amend paragraph [0077] as shown below.

[0077] In a further embodiment, R¹ and R² together form a phenyl ring, and R³ and R⁴ together form a heteroaryl group to give a cyclometallated organometallic compound of the formula II



wherein

M is a transition metal having a molecular weight greater than 40;

ring A is an aromatic heterocyclic ring or a fused aromatic heterocyclic ring with at least one nitrogen atom that coordinates to the metal M;

Z is selected from carbon or nitrogen;

each R⁵ is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two R⁵ groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;

each R⁶ is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two R⁶ groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;

each R is independently selected from H, alkyl, aralkyl, aryl and heteroaryl;

(X and Y), separately or in combination, are an ancillary ligand;

n is 0 to 4;

m is 0 to 4;

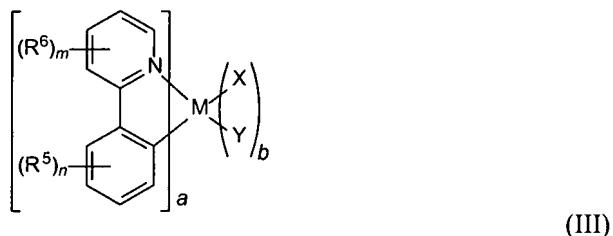
a is 1 to 3; and

b is 0 to 2;

with the proviso that the sum of *a* and *b* is 2 or 3.

Please amend paragraphs [0079]-[0085] as shown below.

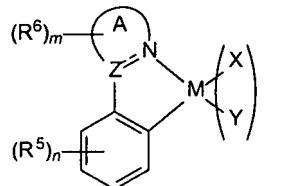
[0079] In a preferred embodiment, the ring A of the compounds of the formula II is a pyridine ring to give a cyclometallated organometallic compound having the formula III



wherein

M is a transition metal having a molecular weight greater than 40;
each R⁵ is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two R⁵ groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;
each R⁶ is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two R⁶ groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;
each R is independently selected from H, alkyl, aralkyl, aryl and heteroaryl;
(X and Y), separately or in combination, are an ancillary ligand;
n is 0 to 4;
m is 0 to 4;
a is 1 to 3; and
b is 0 to 2;
with the proviso that the sum of a and b is 2 or 3.

[0080] In another embodiment of the invention, the organometallic compound may be a square planar compound, in which $a = 1$ and $b = 1$, to give a compound of the formula IV



IV

wherein

M is a transition metal having a molecular weight greater than 40;

ring A is an aromatic heterocyclic ring or a fused aromatic heterocyclic ring with at least one nitrogen atom that coordinates to the metal M;

each R⁵ is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two R⁵ groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;

each R⁶ is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two R⁶ groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;

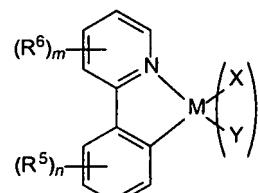
each R is independently selected from H, alkyl, aralkyl, aryl and heteroaryl;

(X and Y), separately or in combination, are an ancillary ligand;

n is 0 to 4; and

m is 0 to 4.

[0081] In a further embodiment of the compound of formula IV, the ring A is a pyridine ring, to give a compound having the formula V



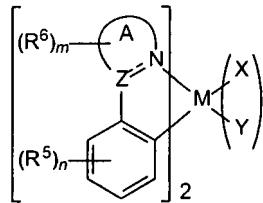
V

wherein

M is a transition metal having a molecular weight greater than 40;

each R^5 is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF_3 , NR_2 , NO_2 , OR, halo, and aryl, and additionally, or alternatively, two R^5 groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;
 each R^6 is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF_3 , NR_2 , NO_2 , OR, halo, and aryl, and additionally, or alternatively, two R^6 groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;
 each R is independently selected from H, alkyl, aralkyl, aryl and heteroaryl;
 (X and Y), separately or in combination, are an ancillary ligand;
 n is 0 to 4; and
 m is 0 to 4.

[0082] In another embodiment of the invention, the cyclometallated organometallic compound may be a compound of the formula II in which $a = 2$ and $b = 1$, to give a compound having the formula VI



VI

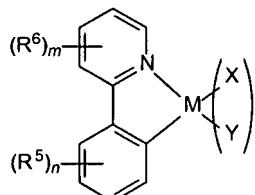
wherein

M is a transition metal having a molecular atomic weight greater than 40;
 ring A is an aromatic heterocyclic ring or a fused aromatic heterocyclic ring with at least one nitrogen atom that coordinates to the metal M;
 each R^5 is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF_3 , NR_2 , NO_2 , OR, halo, and aryl, and additionally, or alternatively, two R^5 groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;
 each R^6 is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF_3 , NR_2 , NO_2 , OR, halo, and aryl, and additionally, or alternatively, two R^6 groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;
 each R is independently selected from H, alkyl, aralkyl, aryl and heteroaryl;
 (X and Y), separately or in combination, are an ancillary ligand;

n is 0 to 4; and

m is 0 to 4.

[0083] In a further embodiment of the compound of formula VI, the ring A is a pyridine ring, to give a compound having the formula VII



VII

wherein

M is a transition metal having ~~a molecular~~ an atomic weight greater than 40;

each R⁵ is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two R⁵ groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;

each R⁶ is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two R⁶ groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;

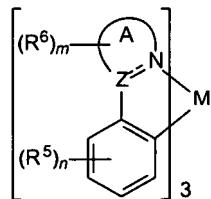
each R is independently selected from H, alkyl, aralkyl, aryl and heteroaryl;

(X and Y), separately or in combination, are an ancillary ligand;

n is 0 to 4; and

m is 0 to 4.

[0084] In another embodiment of the invention, the cyclometallated organometallic compound may be a compound of the formula II in which a = 3 and b = 0, to give a compound having the formula VIII

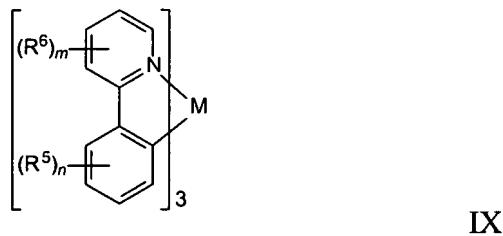


VIII

wherein

M is a transition metal having a molecular weight greater than 40;
ring A is an aromatic heterocyclic ring or a fused aromatic heterocyclic ring with at least one nitrogen atom that coordinates to the metal M;
each R⁵ is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two R⁵ groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;
each R⁶ is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two R⁶ groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;
each R is independently selected from H, alkyl, aralkyl, aryl and heteroaryl;
(X and Y), separately or in combination, are an ancillary ligand;
n is 0 to 4; and
m is 0 to 4.

[0085] In a further embodiment of the compound of formula VIII, the ring A is a pyridine ring, to give a compound having the formula IX



IX

wherein

M is a transition metal having a molecular weight greater than 40;
each R⁵ is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two R⁵ groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;
each R⁶ is independently selected from the group consisting of alkyl, alkenyl, alkynyl, aralkyl, CN, CF₃, NR₂, NO₂, OR, halo, and aryl, and additionally, or alternatively, two R⁶ groups on adjacent ring atoms form a fused 5- or 6-membered aromatic group;
each R is independently selected from H, alkyl, aralkyl, aryl and heteroaryl;
(X and Y), separately or in combination, are an ancillary ligand;

n is 0 to 4; and

m is 0 to 4.